

TOWARDS BETTER QUESTIONS

(ITEM WRITERS' COOKBOOK)



RESEARCH CELL
ASSOCIATION OF INDIAN UNIVERSITIES
NEW DELHI

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Reprinted 1976 (Twice)

Price Rs. 5-00

**Published by the Association of Indian Universities Rouse Avenue,
New Delhi and Printed at Pearl Offset Press 5/33 Kirti Nagar,
Industrial Area, New Delhi-110015.**

FOREWORD

The kind of questions which are asked in university examinations determine, to a large extent, the kind of teaching that is done in the classroom. Most questions which are asked today are stereotyped, repetitive and memory-based. It is only occasionally that questions asked tend to assess the understanding of a student or his ability to apply whatever he has learnt to a problem or situation with which he is not familiar. All this has been recognised for some time but not much has been done to help improve question setting.

In its programme to help the universities to improve their examinations, the Association of Indian Universities has been chosen to give high priority to this particular problem. Ten of the more popular subjects at the undergraduate level were selected. Half a dozen workshops were organised in different parts of the country where teachers worked for approximately one week at a time to prepare these questions. Not only that, some of the teachers at these workshops worked even at home and made questions available to our Research Cell. The questions so framed are in the process of being pre-validated and would be made available shortly.

Meanwhile it has been thought useful to prepare a set of guidelines for teachers. The work done at the various workshops was along these lines. Those interested in this problem would find it useful to study this small booklet carefully. This would enable them to prepare any number of questions in their chosen field.

AMRIK SINGH
SECRETARY,
ASSOCIATION OF
INDIAN UNIVERSITIES

30.9.1976

PREFACE

The core of examination reform in Higher Education lies in the reform of questions/items. Many of us would agree on this that if the questions/items are written with care in a scientific way, the main problem in reform of examinations is already solved. From time to time, university teachers have been trained in the art and science of item writing by various agencies like UGC, AIACHE and ISTE etc. but they have been few and far between. In certain universities, those who underwent training assumed leadership role and trained other teachers similarly. But here again, there has not been enough done to have a real multiplier effect.

The Research Cell of the Association of Indian Universities in its Question Banking Development Project has tried to involve hundreds of teachers to contribute good quality items/questions which will stand upto the rigour of prevalidation. In the process, it was felt that a small booklet outlining the different kinds of questions/items in respect of their design, format and construction, will be a great help to those who have not had the privilege of being exposed to them earlier. It is with this intention this booklet 'Towards Better Questions (Item writers' Cookbook)' is written and it is hoped that this will help teachers and examiners to write reasonably good quality questions/items to begin with. Illustrative examples for different subject areas of Mathematics, Physics, Chemistry, Botany, Zoology, History, Geography, Psychology, Economics and Commerce are given to help teachers/examiners to abstract and use ideas to develop questions/items in their own subject disciplines.

A check list of criteria useful for prevalidation is also included with a view to help individual teachers, groups of examiners and Boards of Examiners to prevalidate their questions and question papers in a rational way.

Suggestions for improvement of this booklet (in terms of its utility) from teachers, examiners and others will be most welcome.

V. Natarajan
Project Officer
(Examinations)

30.9.1976

**TOWARDS BETTER QUESTIONS
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1.0 INTRODUCTION:

With deficiencies galore, it may be difficult to decide priorities in the reform of examination. One sector, however, stands out clearly. It concerns the betterment of questions which are really the stuff our examinations are made of. A question paper cannot be better than the worse questions contained in it. The availability of good questions, therefore, is recognised as an essential prerequisite for examination reform.

A facile way of providing for this could be to establish a collection of questions - a variety of questions/items to cover all intellectual abilities like comprehension, application, analysis, synthesis and evaluation. Such a collection of questions/items, it is felt, can be obtained by adopting a combination of techniques, viz. from past examinations, from item writer sources and from workshops designed to produce a requisite number of good quality questions/items to satisfy criteria in terms of content and outcome. The purpose of this manual is to enable potential item writers to do an effective job.

2.0 DIFFERENT TYPES OF QUESTIONS/ITEMS :

The term "question" is associated with the short and long answer essay type while the word "item" is associated with the objective type. Principally questions/items fall under two broad categories viz. selection type and supply type. In the former, a choice is to be made, which means that there is one and only one predetermined correct answer. This is usually referred to as objective type meaning that the answers can be objectively marked. Supply type questions items require answers to be supplied. The form of the answer may be a single word, number, phrase, sentence or even an essay of two or three pages.: there is a significant degree of freedom to choose, arrange and express the answer.

Supply type questions would be :

1. Simple question (answer is a word, number, phrase or at the most a sentence)
2. Completion (again with a word, number, phrase or sentence)
3. Short paragraph answer (scope limited and direction very clear)
4. Long answer requiring anywhere between 200 to 2000 words.
5. Problem solving type.

Five kinds of items are possible in selection type.
They are :

1. Constant alternatives (True/False ; Yes/No ; Agree/Disagree etc.)
2. Multiple choice (one among 3, 4 or 5 alternatives)
3. Multiple facet.
4. Matching (simple and compound)
5. Rearrangement.

Each of these kinds is discussed below :

3.0 SELECTION TYPE :

1. Constant Alternatives:

Design: The student is required to choose an answer from 2 or more alternatives that remain the same for a series of items. It can take a variety of forms. There may be given certain statements to which a response in terms of True/False ; Yes/No ; Agree/Disagree may be required. Sometimes, a series of True:False items may follow a passage involving comprehension.

Construction: (a) Have approximate equal number of True/False statements.
(b) Statements should be definitively True/False.
(c) Avoid textbook statements.
(d) Avoid use of complex sentences.

Comment: (a) Can provide a wide syllabus coverage.

- (b) Strictly objective scoring is possible.
- (c) Good T/F items are very difficult to construct.
- (d) Influenced by response sets.
- (e) May have to correct scores for guessing.

2. Multiple Choice :

This is the most versatile of all objective type test items. The multiple choice item mainly consists of :

- (a) stem : which is at the top of the item either in the form of a direct question or an incomplete statement.
- (b) options : usually 3, 4 or 5 of these are given as (a), (b), (c), (d) etc. one below the other.
- (c) key : the correct answer among the options.
- (d) distractors : options other than the key.

An example :

```

      { stem ( How well a child progresses in its early
      {      ( years of schooling depends mainly on the
Item {  options:  (a) intelligence of the child ) dis-
      {          (b) social class of the parents ) tract-
      {          (c) quality of the teaching ) ors
      {          (d) attitude of its parents - key option
  
```

Design:

The student is required to select the correct answer from a group of several alternatives.

Construction:

- (a) The stem may be a direct question or an incomplete statement ; if latter, it should imply a question.
- (b) Distractors must be plausible. They must act as "distractors" to higher ability students and attractors to lower ability students (use completion test item responses of students as source).

- (c) Length and precision of correct answer should not provide a "clue".
- (d) Arrange correct responses randomly.

Comment:

- (a) Strictly objective scoring is possible.
- (b) Can test a wide variety of abilities.
- (c) Possibility of guessing is reduced.
- (d) Produces a reliable test.
- (e) Not easy to construct.
- (f) Provides highest quality items.

Multiple choice items are used to check knowledge, comprehension & application levels. They offer a wide scope for higher order abilities like analysis, synthesis, and evaluation, though it may be difficult to create items to check these. If multiple choice items are to yield very good results certain principles discussed elsewhere in this manual must be adhered to. In a test of 100 items, 80 to 90 must be of multiple choice. A few of the rest can be True/False type and the remaining can belong to other categories of matching/rearrangement etc.

3. Multiple Facet:

This is simply a number of multiple choice items one below the other relating to various aspects of the same theme presented as material, picture or diagram or a combination of these. A series of multiple choice questions will enable examining multiple knowledge about a single topic. Multiple abilities about the same topic can also be tested.

Design:

The student is required to go through the material, picture or diagram or a combination of these and then proceed to select the correct answer for each one of the series of items that follow .

Construction : Same as for multiple choice (a) to (d). Sometimes, the student may be asked to make one of the 4 kinds of judgement (provided as key) regarding a series of statements, these judgements being the same for all the statements in the series.

Comment : Same as for multiple choice (a) to (f).
(g) Particularly useful for testing higher order intellectual abilities.
(h) Can be used to test various abilities required of the same theme.

(4) **Matching Item** :

Design : This type of item usually consists of two lists called premises and responses. The student is required to match a premise with a response. This is simple matching. In compound matching, a premise may have to be matched with 2 or more responses. A careful look at this item will reveal that it is only a number of multiple choice items put together.

Construction :

- (a) Have an explicit basis for matching.
- (b) Number of responses must be more than the number of premises.

Comment :

- (a) Strictly objective scoring is possible.
- (b) Relatively easy to construct.
- (c) Reduced opportunities for guessing.
- (d) Can make a rapid survey of a subject.
- (e) Not suitable for testing higher order abilities.

5. **Rearrangement Item:**

Design: The student is required to put into order a set of randomly presented material.

Criteria: Chronological, size, order of events.

Comment: Mental processes for answering depend on how the subject matter has been taught.

4.0 SUPPLY TYPE:

In this major category of items/questions type, a student is asked to supply an answer.

1. Simple Question:

<u>Design:</u>	A direct question) produces (a number
)	(a word
	A specific) as	(a
	direction)	(phrase
) response (or a
	A stimulus)	(sentence

Construction:

- (a) Elicit short, clear cut answers.
- (b) Decide if spelling mistake is to be penalised.
- (c) Minimise use of textbook expressions.

Comment:

- (a) Eliminates possibility of guessing.
- (b) A natural form of question easily prepared.
- (c) Some responses need expert judgment.
- (d) Scoring is not completely objective.
- (e) Can usually test only lower order abilities.

2. Completion:

Design: The student has to "write in" a number, a word, a phrase or a sentence.

Construction: (a) to (c) as for simple question above.
(d) If more objectivity in marking is required, this can be made into a multiple choice item.
(e) The item with blank spaces must make sense.

Comment: As for simple question above.

3. Short Answer:

This type of question calls for a very short answer either in the form of a few sentences or a diagram or numerical working or a combination of these. The student is given the freedom to choose, organise and present his answer. This stresses the return of certain information in a well organised manner. There is no verbiage - usually only a paragraph is needed to respond ; easier to evaluate reliably.

Design: A direct) produces (a few
question) (sentence
A specific) as (a diagram
direction) (a numerical
response (marking
A stimulus) (

The direction in the question must be clear and the scope of the answer must be limited.

Construction (a) Avoid using "briefly" , "short notes on","what all you know" etc.
(b) As far as possible use action oriented and precise verbs.
(c) Keep the question as long as possible but make the answer short.

Comment : (d) Present a clearly defined task.
(a) A natural form of question.
(b) Useful for testing comprehension, application, & other higher order abilities.

(c) Limits or restricts the response.

4. Long Answer:

We are all familiar with this type of question. It can be of two types : (1) restricted response and (2) unrestricted response.

Design:

The design is quite open but a few clues can be given. There are 12 major categories (Weidemann 1970)

- (a) Who, what, when, where, which, whence, whom.
- (b) define, state, indentify, quote, recite, designate, name.
- (c) list, enumerate, trace, arrange in order.
- (d) outline, organise, classify.
- (e) describe (an object or procedure), narrate, write about.
- (f) contrast, distinguish, discriminate, differentiate.
- (g) compare, list similarities, dissimilarities.
- (h) explain, show how, show why, give explanatory reasons.
- (i) discuss, defend, refute, prove, disprove, justify.
- (j) develop (discussion by multiple interpretation)
- (k) summarise, integrate.
- (l) consider, judge, evaluate.

Long answer questions to test higher order abilities are those that involve types from (f) to (l) . Monroe and Carter give a somewhat refined and precise classification of essay questions :

- (a) Selective recall-basis given.
- (b) evaluating recall.
- (c) comparison of two things on a single designated basis.
- (d) comparison of two things in general .
- (e) decision for or against.

- (f) cause or effect.
- (g) explanation of the use or exact meaning of some phrase or statement in a passage.
- (h) summary of some unit of the text or of some article read.
- (i) analysis.
- (j) illustration (with own examples)
- (k) classification.
- (l) application of rules or principles in new situations.
- (m) discussion.
- (n) statement of aim - authors' purpose in his selection or organisation of material.
- (o) criticism as to adequacy, correctness or relevance.
- (p) outline.

Construction:

- (a) Avoid phrases like "write all that you know about", "discuss briefly", "explain briefly" etc.
- (b) let the question be not open, vague and ambiguous.

Comment:

- (a) Requires the student to organise, synthesise and present his answer.
- (b) suitable for testing higher order abilities of application, analysis, synthesis and evaluation.
- (c) Unrestricted response type stresses depth and scope of knowledge ; emphasises freedom of expression and encourages critical thinking and originality.
- (d) difficult to evaluate the answer reliably.
- (e) Adequacy as a test of the student's ability to express himself; depends on the adequacy of time, ability level of students to respond, emotional conditions, etc.

- (f) very often questions (even those that seemingly require students to criticise) degenerate into simple recall questions.

5. Problem Solving:

Design: A situation representing a problem may be given. This may produce a verbal explanatory answer or a numerical working. For closed ended problems, there will be only one answer or one way of answer. These will ensure reliable marking. Very often, problems may be open ended giving rise to many forms of solutions . This will particularly enable testing the ability to judge and evaluate, when the student is asked to choose one of the several alternative solutions using a given criterion.

Construction: Avoid familiar problem types in texts etc.

Comment: (a) Use this type to test application, evaluation etc.
(b) Use a new situation to ensure real application.

5.0 QUESTIONS/ITEMS FOR HIGHER ORDER ABILITIES:

Many subjects at the graduate level demand not only recall ability on the part of students but to a very large extent require students to display higher order intellectual abilities , in dealing with the information, data etc. These intellectual higher order abilities are

Comprehension: translation, interpretation, manipulation, extrapolation etc.

Application: in new situations; solving problems involving new situations i. e. situations other than those dealt with in the classroom or in the text; solving closed ended as well as open ended problems.

Analysis: information, data to be dissected; situation to be broken into constituents; piece of information looked at in parts.

Synthesis: pieces put together to constitute the whole; arranging, ordering the information to a coherent whole; preparing a plan; getting up a final drawing; given information, data in parts, to put them back to give concrete, wholesome meaning.

Evaluation: judging the adequacy, accuracy, relevance of data; evaluating every step of a series of steps; making decision; concluding.

Many educationists feel that knowledge, comprehension and application are invariably content oriented, content dependent and are controlled by the nature, depth and quantity of content. Analysis, synthesis and evaluation, on the other hand, are the kinds of abilities which are content independent. They are not controlled by the nature, depth and quantity of content alone. They depend to a large extent on the level at which subjects are taught and the level which the students are capable of. Many educationists also believe that objective type test items are not capable of testing higher order abilities like analysis, synthesis and evaluation. This is more competently done by short answer and long answer types, they feel they are right to some extent. It is difficult to make objective items for higher order abilities; but certainly not impossible. With an equal or a little more time, effort and thinking on the part of the item writer than given to formulating short and long answer questions, he can use objective type test items to test higher order abilities.

6.0 PRINCIPLES OF ITEM WRITING:

Once the controlling principles in item writing are understood, item writers will be able to operate at a level higher than that of novices. Hence these principles are discussed in detail. Wherever possible, each principle is illustrated with an example ; where the principle is pretty simple, illustration may not be there. These principles fall into two categories , viz.

General for all item types and

Specified to the particular item type.

General Principles:

- (a) The item must measure an important learning outcome.
- (b) The item must concern an important content area.
- (c) The level of difficulty must be appropriate to the level of student's learning.
- (d) The item must be answered correctly by many higher ability students.
- (e) The item must be answered wrongly by many lower ability students.
- (f) The item must be independent and not overlap with other items.

Specific Principles:

(a) for constant alternatives:

- 1. The item must include only one central idea in a statement.
- 2. The statement must be so precise that it can be judged unequivocally true or false.

Example :

The deflection of a beam will be increased by decreasing second moment of area of cross section, other things remaining the same.

True ☐ False ☐

If sufficient care is not taken to include the underlined phrase in this item, the item may be true or false.

3. The statement should be brief and in simple language.

Example :

The paucity of probable but incorrect statements that can be related to a central idea may pose a problem when constructing the multiple choice item.

True ☐ False ☐

Suggested improvement :

The lack of probable wrong answers will present the greatest difficulty when constructing multiple choice items.

True ☐ False ☐

4. The item must use negative statements sparingly and avoid double negatives.

(b) for multiple choice/multiple facet :

1. The stem should be concise and unambiguous, avoiding negatives. If unavoidable, negatives must be emphasised.

Example :

Which of the following is NOT a major characteristic of programmed instructions ?

- (a) the material is reduced in small steps
 - (b) the student is required to make frequent responses
 - (c) correct responses are immediately confirmed
 - (d) students must reach the frame at a uniform rate.
2. The stem must be complete question by itself, not requiring student to read the option in order to discover what is being asked.

Example : 1

An example of a supply type test item is a

- (a) multiple choice item
- (b) true/false item
- (c) matching item
- (d) short answer item

Since the options are quite short, not much time is wasted in reading through the options.

Example : 2

Which of the following statements concerning test validity and reliability is most accurate ?

- (a) a test cannot be valid unless it is reliable

- (b) a test cannot be valid unless it is objective
- (c) a test cannot be reliable unless it is valid
- (d) a test cannot be reliable unless it is standardised.

In this item, one has to go through options one after the other. More time is involved and this will motivate guessing. Some item writers will insist on having one or two of these items since they argue that a kind of judgement has to be made going through options one after the other. This is particularly so in the case of items testing higher order intellectual abilities.

The context of the question must be made clear i.e. the subject matter topic must be stated if there is any chance of confusion.

Example :

In objective testing, the term objective refers to

- (a) indentifying the learning outcomes
- (b) selecting the test content
- (c) presenting the problem
- (d) scoring the answers.

Here the phrase "in objective testing" makes clear the context of the question. The word "objective" has apparently different meanings in different contexts.

4. Anything that needs to be repeated in each option should be included in the stem.

Example :

The lack of probable wrong answers will cause the greatest difficulty

- (a) when constructing short answer items
- (b) when constructing multiple choice items
- (c) when constructing true/false items
- (d) when constructing essay questions

Here, "when constructing" shall go into the stem.

5. The options should be parallel in content i.e. they should all have the same kind of relationship to the stem.

Example :

Obtaining a dependable ranking of students is of major concern when using

- (a) general achievement tests
- (b) behaviour descriptions
- (c) check lists
- (d) questionnaires

Here better options for (b), (c) and (d) will be

- (b) diagnostic tests
- (c) mastery tests
- (d) pretests

6. The options should be parallel in structure i.e. they should fit grammatically with the stem. (Consistency of all options with the stem in terms of tense, article, grammatical form.)

Example :

The ability to synthesise can be best measured with an

- (a) essay question
- (b) matching item
- (c) multiple choice item
- (d) rearrangement item.

Here a student who knows grammatical English will choose option (a) for answer, even without knowing his subject since it only fits with the stem.

7. The item must not contain any clues such as mixtures of plurals and singulars, precision of key option, length of key option etc.

Example :

Why should negative terms be avoided in the stem of a multiple choice item ?

- (a) they may be overlooked
- (b) the stem tends to be longer
- (c) the construction of alternatives is more difficult
- (d) the scoring is more difficult.

The improved version may be

Why should negative terms be avoided in the stem of a multiple choice item ?

- (a) they may be overlooked
 - (b) they tend to increase the length of the stem
 - (c) they make the construction of alternatives more difficult
 - (d) they increase the difficulty of scoring.
8. The key option must be unarguably correct. This means that there is one and only one predetermined correct answer, a prerequisite for an objective type test item.
9. The distractors must be incorrect, yet likely to be plausible to weaker students. To realise this
- (a) Use the common misconceptions or common errors of students as distractors (use completion item responses as a source).
 - (b) State the options in the language of the student.
 - (c) Use fine sounding words (i. e. accurate, important etc.) in the distractors as well as in the correct answer.
 - (d) Make the distractors similar to the correct answer in both length and complexity of wording.
10. The option "all of these" should never be used and on rare occasions when "none of these" can be justified as an option, its existence should be indicated in the stem.

11. Although brevity and precision are required in the item as a whole, the language used must be appropriate to the vocabulary of the students.
12. Avoid similarity of wording in both the stem and the correct answer.

Example :

Which one of the following would you first consult to locate research articles in achievement testing ?

- (a) Journal of Educational Psychology
- (b) Journal of Educational Measurement
- (c) Journal of Consulting Psychology
- (d) Review of Educational Research.

Everyone will choose (d) obviously.

13. Do not include two responses that are "all inclusive" or that have the same meaning.

Example :

Which one of the following types of test items measures learning outcomes at the recall level ?

- (a) supply type items
- (b) selection type items
- (c) matching items
- (d) multiple choice items.

In the presence of (a) and (b) all inclusive, (c) and (d) are superfluous. Choice is between (a) and (b) only.

14. Vary the position of correct answer randomly.

15. Use an efficient item format

(a)

(b)

(c)

(d)

and not (a), (b)

(c), (d)

(c) for matching item :

1. The item must include only homogeneous material in "premises"
2. The number of responses must be large enough so that the last of the premises can still have many options to choose from.
3. The item must specify the basis of matching, type of matching, kind of entry etc.

7.0 PRINCIPLES OF QUESTION WRITING :

(a) Simple question/completion :

1. The item must be so stated that only a single brief answer is possible (a number, word or phrase).
2. The question must be direct.
3. The answer must be related to the main point in the statement.

4. The item with the blank spaces must make enough sense.

Example :

bad one :psychologist,
developed.....at
university in

good one : The test taken by a
student at the end of a programme
is called atest.

5. In the case of a numerical answer, the item must indicate the degree of precision.

(b) SHORT ANSWER/LONG ANSWER/PROBLEM SOLVING :

1. The statement of the question must be clear and unambiguous.
2. The scope of the answer must be limited (short answer type only).
3. The direction given in the question should be clear.
4. The question must be a valid testing situation for the ability considered.
5. The question must be related to an important content area.
6. The question must be interpreted in the same way by teachers and students.
7. The answer to the question must be capable of being marked objectively (short answer).
8. The question must be correctly answered by many higher ability students and wrongly by many lower ability students.
9. The question must be independent and it should not overlap with other questions.

8.0 CHECKLIST OF CRITERIA FOR PREVALIDATION :

Criteria to judge the quality of objective type items may be those generally applicable and those applicable specifically to a type.

General Criteria :

1. Does the item measure an important learning outcome ?
2. Does the item measure an important content area ?
3. Is the level of difficulty likely to be right ?
4. Is the item likely to be answered correctly by higher ability students ?
5. Is the item likely to be answered wrongly by lower ability students ?
6. Is the item independent or does it overlap with other items ?

Specific Criteria :

(a) for constant alternatives :

1. Does the item include only one significant idea in each statement ?
2. Is the statement so precise that it can be judged unequivocally true or false ?
3. Is the statement short and using simple language ?
4. Does the item use negative statements sparingly and avoid double negatives ?

(b) for multiple choice/multiple facet :

1. Is the stem concise and unambiguous ?
Is the negative (if unavoidable) emphasised ?
2. Is the stem a complete question by itself ? Does the item require the student to read the options to discover what is being asked ?
3. Is the context of the question clear ?
4. Does the stem include anything that needs to be repeated in every option within itself ?
5. Are the options parallel in content ?
6. Are the options parallel in structure ?
7. Is the stem devoid of any clues such as mix up of singular, plural, precision and length of key option etc. ?
8. Is the key option unarguably correct ?
9. Are the distractors plausible ?
10. Does the item exclude "all of these" ?
11. Is the language used in the item appropriate to the vocabulary of the students at this level ?
12. Does the item avoid similarity of wording in both stem and the correct answer ?
13. Does the item exclude responses that are "all inclusive" ?
14. Does the item use an efficient format ?

(c) for matching :

1. Does the item include only homogeneous material in the "premises" ?
2. Is the number of responses sufficiently large so that the last of the premises can still have many options to choose from ?
3. Does the item specify the basis for matching, type of matching, kind of entry etc, ?

(d) for simple question/completion :

1. Is the item stated so that a single, brief answer is possible (a word, number or phrase) ?
2. Is the question direct ?
3. Is the answer related to the main point in the statement ?
4. Does the item with the blank spaces make enough sense so that a student knows what to do ?
5. Does the item in the case of a numerical answer indicate the degree of precision ?

(e) for short answer questions :

1. Is the statement of question simple, clear, unambiguous ?
2. Does the question involve observable, measurable behaviour ?
3. Is the scope of the answer limited ?
4. Is the direction given in the question clear ?

5. Is the question a valid testing situation for the ability considered ?
6. Is the question likely to be interpreted in the same way by teachers/students/examiners ?
7. Is the answer to the question capable of being marked objectively ?
8. Is the question likely to have the right kind of difficulty value ?
9. Is the question likely to be correctly answered by many higher ability students ?
10. Is the question likely to be wrongly answered by many lower ability students ?
11. Is the question capable of further restructuring ?

(f) for long answer :

This of course is something very familiar to all of us. It is better that we use it for testing higher order abilities and not waste it on testing knowledge and understanding.

9.0 ILLUSTRATIVE EXAMPLES :

What follows are an example each of the various types of questions/items discussed above, illustrating their nature and normative principles. Their domain is the first degree level in mathematics, physics, chemistry, botany, zoology, psychology, history, geography, commerce and economics.

1. CONSTANT ALTERNATIVES :

Mathematics :

The logarithm of 903 is 2.955688

Therefore the logarithm of 9.03 is
0.955688

True ☐ False ☐ Don't know ☐

Physics :

A ray is deviated towards the normal
when it passes from one medium into
another with a higher refractive index.

True ☐ False ☐ Don't know ☐

Chemistry :

If hydrogen sulphide is bubbled through
an acidified solution of potassium
dichromate, the solution turns green
with a yellow precipitate.

True ☐ False ☐ Don't know ☐

Botany :

The outer layer of palisade-mesophyll
cell in a leaf is made of cellulose.

True ☐ False ☐ Don't know ☐

Zoology :

The main parts of the cell are the
chromosomes, nucleus and cytoplasm.

True ☐ False ☐ Don't know ☐

Psychology :

The adolescent period is sometimes a period of disorganisation and conflict largely because the rapid physiological growth occurring at this time is a drain on the mental resources of the adolescent .

True ☐ False ☐ Don't know ☐

History :

The declaration of the Rights of Man was issued by the National Convention.

True ☐ False ☐ Don't know ☐

Geography :

Rapid surface erosion by running water would be most likely to occur in a region of clear tilled-row-crops.

True ☐ False ☐ Don't know ☐

Commerce :

"A manufacturer borrowing money to buy raw materials" is an example of commercial credit.

True ☐ False ☐ Don't know ☐

Economics :

A reduction of discount and rediscount rates is expected to counteract a recession and to promote a recovery.

True ☐ False ☐ Don't know ☐

2. MULTIPLE CHOICE :

Mathematics :

If $x + 2 = y$, what is the value of $\frac{1}{x - y} + \frac{1}{y - x}$?

- (a) -4
- (b) 0
- (c) 2
- (d) 4
- (e) it cannot be determined from the information given. ☐

Physics :

A and B are two moving bodies, mass of A being twice that of B. If they have the same momentum;

- (a) A has greater kinetic energy
- (b) B has greater kinetic energy
- (c) A and B have the same kinetic energy
- (d) A and B have the same velocity. ☐


Chemistry :

The equivalent conductance of a solution of an electrolyte increases with dilution because of

- (a) increase in the mobility of ions
- (b) increase in ionisation
- (c) increase in the mobility and increased ionisation
- (d) decrease in the viscosity of the medium. ☐

Botany :


Which one of the following is the outstanding adaptation in a xerophytic plant towards surviving in severe drought conditions ?

- (a) Its ability to reduce transpiration
- (b) Its capacity to absorb all the available water by a highly developed root system
- (c) The development of cork tissue and cuticle
- (d) Its remarkable ability to withstand permanent injury to protoplasm by loss of water
- (e) The development of well developed conducting system. 

Zoology :

Black eye colour is dominant over blue in man. A black eyed couple had among their children one with blue eyes. The gene types of the parents are

	Mother	Father
(a)	Bb	Bb
(b)	BB	Bb
(c)	Bb	BB
(d)	BB	BB



Psychology :

Which of the following best illustrates "reaction formation" ?

- (a) A student develops acute asthmatic attacks before examinations.

- (b) A student who fails history explains that the teacher was against him from the beginning of the course
- (c) A young wife who resents the responsibilities of motherhood is overly solicitous about her children
- (d) A man vents his feelings towards a tyrannical employer on his wife and children
- (e) A soldier develops amnesia after deserting under fire. ☐

History :

In which of the following groups did all the historians write important books on the period 400 to 1600 ?

- (a) Edward Gibbon, Marc Bloch, W. W. Tarn
- (b) Jacob Burchhardt, Henri Pirenne, Johan Huizinga
- (c) Ferdinand Lot, Theodore Mommsen, Lord Macaulay
- (d) Leopold von Ranke, Michael Rostovitzeff, Voltaire ☐
- (e) F. W. Maitland, Warner Sombart, Lord Acton ☐

Geography :

Which of the following is the most acceptable statement regarding the earth's present surface terrain ?

- (a) It resulted from a period of tectonic inactivity during which only gradational forces operated
- (b) It resulted from processes operating within the earth's crust and agents acting on the surface during the latter part of Cenozoic Era

- (c) It resulted from the breaking down and removal of the surface material by water, wind and ice
- (d) It is largely a consequence of a series of catastrophic geologic events that wrenched, twisted and folded the crust
- (d) Most of it has been shaped by ice caps and glaciers of former times ☐

Commerce :

Which one of the following is an example of commercial credit ?

- (a) A manufacturer borrows money to buy a new plant
- (b) A manufacturer borrows money to buy raw materials
- (c) A business executive borrows money to build a new house
- (d) A stock broker borrows money to buy stocks and bonds. ☐

Economics :

An increase in demand can be caused by

- (a) a fall in the price of the commodity
- (b) a rise in the price of a commodity
- (c) a fall in the income of the consumer
- (d) a rise in the income of the consumer
- (e) a fall in the price of the substitute

Mathematics :

Each of the items refers to the set of curves corresponding to the equation $y = x^2 + ax + b$. You are to complete in each case a statement about this set of curves.

1. A curve of the set will pass through the origin if
- (a) $a=0$
 - (b) $b=0$
 - (c) $a=b$
 - (d) $a=2b$



2. A curve of the set will have no point in common with x axis if

- (a) $a^2 - 4b < 0$
- (b) $a^2 - 4b > 0$
- (c) $a=0$
- (d) $a^2 = 4b$



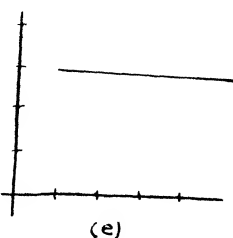
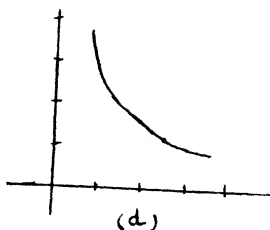
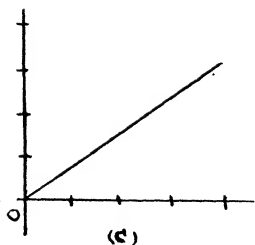
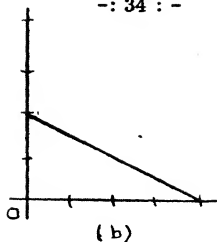
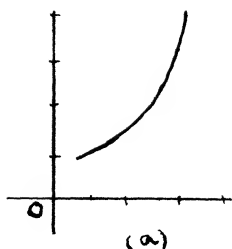
3. A curve of the set will have just one point in common with the x axis if

- (a) $a^2 - 4b < 0$
- (b) $a^2 - 4b > 0$
- (c) $a^2 = 4b$
- (d) $b=0$



Physics :

Items (1) to (4) below relate to a pair of optical experiments. Each item is to be answered with one of the five graphs below. The horizontal axis of the graph represents the object distance. A graph may be used once, more than once or not at all.



An object is placed at the principal focus of a converging lens and moved slowly away from the lens.

1. Which graph could represent the location of the image as the object moves away ? ☐
2. Which graph could represent the product of the object distance times the image distance as the object moves away ? ☐
3. Which graph could represent the height of the image as the object moves away ? ☐
4. The object is now placed at the principal focus of a parabolic mirror and moved away from the mirror. As the object moves away which graph could represent the ratio $\frac{\text{Object size}}{\text{Image size}}$ ☐

Chemistry :

One or more of the following salts were used in preparing a sample for analysis :

AgNO_3 , $\text{Al}(\text{NO}_3)_3$, BaCl_2 , K_2CrO_4 ,
 MgSO_4 , NaI , $\text{Pb}(\text{NO}_3)_2$

The sample dissolves completely in water to give an orange solution which turns a cloudy greenish brown on acidification with hydrochloric acid. The mixture is filtered. A portion of the clear filtrate is made strongly alkaline with sodium hydroxide solution. A white precipitate remains. Using the information given above, decide which salts were used in preparing the sample.

Use A if the salt was used

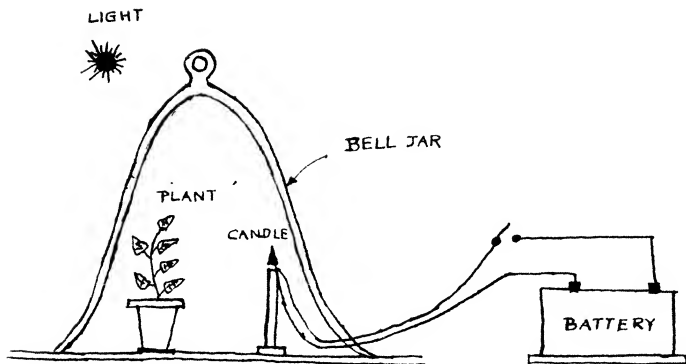
Use B if the salt was not used

Use C if the information given is not sufficient to decide.

1. AgNO_3 ☐
2. $\text{Al}(\text{NO}_3)_3$ ☐
3. BaCl_2 ☐
4. K_2CrO_4 ☐
5. MgSO_4 ☐
6. NaI ☐
7. $\text{Pb}(\text{NO}_3)_2$ ☐

Botany :

Supposing the following experiment is done for the purpose of showing that a plant growing in a bell jar decreases the amount of carbon dioxide and increases the amount of oxygen in the bell jar. A plant and a burning candle are placed beneath a bell jar as shown. The candle burns one minute and then goes out. Three days later the candle is ignited by means of the electrical apparatus and burns one minute before going out.



1. Which of the following questions is answered by the experiment. ?
 - (a) Do all parts of a plant take up CO_2 and give off O_2 ?
 - (b) Do plants require light to take up CO_2 and give off O_2 ?
 - (c) Do plants and burning candles have the same effect on air ?

- (d) Is the amount of CO_2 taken up by a plant greater than the amount of O_2 given off ? ☐
2. Before any conclusions could be drawn from this experiment the experiment should be repeated with which one of the following changes ?
- (a) use a larger bell jar
 - (b) omit the candle
 - (c) omit the plant
 - (d) ignite the candle with a concentrated beam light. ☐
3. Suppose it is definitely shown that a plant growing in a bell jar decreases the CO_2 and increases the O_2 present. How is this finding related to the observation that plants restore the ability of air to support the burning of a candle ?
- (a) It adds information which contradicts the observation
 - (b) It adds information which fits with the observation
 - (c) It adds nothing to the observation
 - (d) It and the observation cannot both be correct. ☐

Zoology :

In a certain organism, long body (L) is dominant to short body (l) and striped body (S) is dominant to speckled body (s) . A cross between an LlSs male and llss female produces F_1 progeny as follows :

	Males	Females
Long striped body	50%	50%
Short speckled body	50%	50%

1. The percentage of F_1 phenotypes is explained by which of the following postulates of genetic theory ?
 - (a) nondisjunction of adjacent chromosomes
 - (b) erasing over of genes L & S
 - (c) sex linkage of gene L & s
 - (d) linkage of genes on the same pair of chromosomes ☐
2. If Mendel had obtained these results, which of the postulates in his theoretical model of the genes would he have had to reject ?
 - (a) There are determiners for hereditary traits
 - (b) Hereditary determiners sort independently of one another
 - (c) Hereditary determiners do not influence one another
 - (d) The hereditary determiners can be either dominant or recessive ☐


Psychology :

Read the following passage and answer the items that follow:

Since the variables relating to thinking have by no means been adequately investigated, it is not surprising that conflicting theoretical positions have been advanced.

At one extreme, it has been maintained that thinking is dependent only upon the formation and elicitation of vast number of simple associations. The other extreme maintains that thinking is dependent upon some fundamentally different type of process from that involved in the association of stimuli and responses.

Those individuals who advocate the former position might be described as the "uni-process" theorists and those who advance the latter position, the "dual-process" theorists. Even the extremists, however, frequently offer some indications of compromise - the uni-process advocates striving to find some mechanism that will give selectivity, the dual process advocates offering to submit their higher type process to autogenetic analysis.

1. Primary emphasis on the role of previously learned responses in the solution of problems would indicate preference for
 - (a) a uni-process approach
 - (b) a dual process approach
 - (c) an approach involving both positions
 - (d) an approach involving some third process
 - (e) an approach that makes no assumptions regarding the number of processes involved. 

2. Which of the following pairs of terms corresponds LEAST well to the uni-process, dual process distinction ?

- (a) "concrete" attitudes and "abstract" attitudes
- (b) "trial and error" and insight
- (c) "reproductive" thinking and "productive" thinking
- (d) "structuring" and "restructuring"
- (e) "unitelligent" behaviour and "intelligent" behaviour ☐

3. Which of the following correctly pairs an exponent of the dual process with an exponent of the uni-process ?

- (a) Hull ... Harlow
- (b) Köhler ... Tolman
- (c) Maier ... Hull
- (d) Spence ... Watson
- (e) Goldstein ... Wertheimer ☐


History :


Read the following question carefully. For each of the items following, choose the best answer.

"And what are the different classes of legislators but advocates and parties to the causes where they determine ? Is a law proposed concerning private debts ? It is a question to which creditors are parties on one side and the debtors on the other. Justice ought to hold the balance between them. Yet the parties are and must be


themselves the judges and the most numerous party . . . must be expected to prevail. "

Madison - Federalist No. 10


1. The solution which Madison proposes to the problem described in the quotation is a government which
 - (a) performs its functions in a society free from faction
 - (b) would render it difficult for the majority to concert and execute certain acts
 - (c) provided by law that no measure affecting property could be passed by the legislative
 - (d) banned any party which was grounded in factionalism
 - (e) succeeded, as he felt the constitution would in providing laws which were a clear expression of the popular will. 
2. The solution could be achieved, Madison thinks, through
 - (a) a constitution which embodies, checks and balances and thus can prevent domination by the propertied minority
 - (b) reducing through education and wise laws, the diversity of interests among the citizens
 - (c) a parliamentary republic characterised by a few large parties
 - (d) a popular government in an extensive and populous country

- (e) a small representative government. 

3. Further, Madison believes that a successful solution required

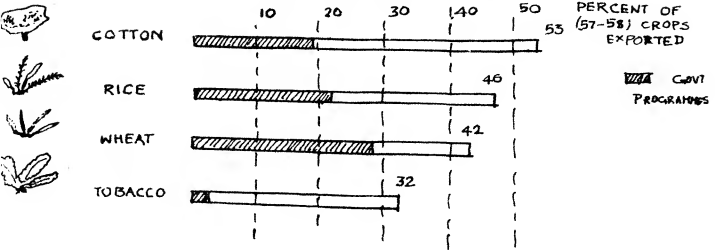
- (a) the election of representatives by the people
- (b) that all existing parties would put the country's welfare above their own
- (c) a major dependence on good statemanship to control the effects of faction
- (d) a way of electing the legislative which would make them sensitive to change in popular opinion. 

4. The solution named in item (2) assumes that

- (a) there are only a few important issues which may serve as a basis for factions
- (b) all people are substantially equal in abilities and thus can be brought to agree with one another on important problems
- (c) diversity of physical environment would create a diversity of interests
- (d) the more responsive a government is to the popular will, the better it is. 

Geography :

Read the chart below and answer the items following



Use A if the statement is supported by the evidence given in the chart

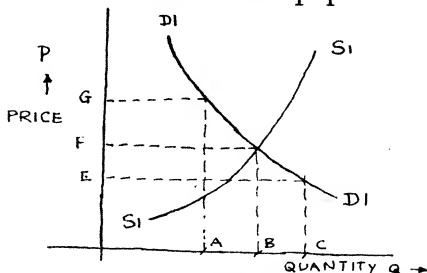
Use B if the evidence in the chart is not sufficient to determine whether the statement is correct or incorrect

Use C if the statement is contradicted by the evidence in the chart

1. The total farm economy of the US depends upon exports ☐
2. Less than 50 per cent of exports of agricultural product are government sponsored ☐
3. Rice was the largest item in government sponsored programmes ☐
4. The US consumes about two-thirds of the tobacco produced ☐
5. The US keeps for its own use over half of the rice and wheat grown ☐
6. Cotton exports would suffer least from the withdrawal of government sponsored programmes. ☐

Commerce :

Figure shows a demand curve $D_1 D_1$ and a supply curve $S_1 S_1$



1. Equilibrium price is measured by

- (a) OE
- (b) OF
- (c) OG
- (d) FG
- (e) EF




2. Assume that a government regulation fixes a maximum price of OE. Other things being equal, supply would

- (a) not be affected in any way
- (b) increase from OB to OC
- (c) increase from OA to OC
- (d) contract from OB to OA
- (e) contract from OC to OA



3. Assume that a government regulation fixes a maximum price of OE. Other things being equal, demand would

- (a) not be affected in any way
- (b) increase from OB to OC

- (c) increase from OA to OC
- (d) contract from OB to OA
- (e) contract from OC to OA 

Economics :

The Reserve Bank of India acts as a lender of last resort to

- (a) Life Insurance Corporation of India
- (b) Stock Exchange Market
- (c) Scheduled Commercial Banks
- (d) State Cooperative Banks
- (e) Private business houses

When the Reserve Bank directs the Commercial Banks for special deposits its object is to

- (a) increase the liquid assets of Commercial Banks
- (b) reduce the liquid assets of Commercial Banks
- (c) reduce the volume of treasury bills

Assume the Reserve Bank of India raises the bank rate, the result will be

- (a) all the other banks in the country will increase their lending rates
- (b) all the other banks will reduce their lending rates
- (c) a contraction in the loans advanced by the banks
- (d) an expansion in the loans advanced by the banks

4. MATCHING ITEM :

Mathematics :

If $a \text{ I } b = \frac{a}{a+b}$;

$a \text{ I}^2 b = (a \text{ I } b) \text{ I } (a \text{ I } b)$

$a \text{ n } b = \frac{ab}{1-a^n}$ where n is a natural number and, a, b are any positive real numbers

Then match list A with list B.

<u>List A</u>		<u>List B</u>
1. $a = x \text{ I } b$	<input type="checkbox"/>	(a) $x = \frac{a(1-b)}{b}$
2. $b = a \text{ I } x$	<input type="checkbox"/>	(b) $x = 1-b$
3. $a = x \text{ I}^2 b$	<input type="checkbox"/>	(c) $x = \frac{ab}{1-a}$
4. $x \text{ I } b = x \text{ I } b$ where $x=0$	<input type="checkbox"/>	(d) $x = \frac{a}{a+b}$
5. $a \text{ I}^2 b$ equals	<input type="checkbox"/>	(e) $\frac{a^2}{b(a+b)}$
6. $(a \text{ I } b) \text{ I } (a \text{ I } b)$ equals	<input type="checkbox"/>	(f) $1/2$
		(g) 1
		(h) $\frac{ab}{1-a^2}$
		(i) $x = \frac{a}{ax+b}$

Physics :

Match items in list A with name of apparatus in list B.

<u>List A</u>	<u>List B</u>
1. to detect the presence of a certain element in a star <input type="checkbox"/>	(a) aneroid
2. to measure the temperature of molten gold <input type="checkbox"/>	(b) Bourdon spring gauge
3. to measure humidity of air <input type="checkbox"/>	(c) Cavendish apparatus
4. to measure atmospheric air <input type="checkbox"/>	(d) diffraction grating
5. to measure electron velocity <input type="checkbox"/>	(e) electrophorus
6. to detect presence of isotopes <input type="checkbox"/>	(f) electrostatic voltmeter
7. to measure velocity of sound in metal <input type="checkbox"/>	(g) hydrogen thermometer
	(h) hygrometer
	(i) Interferometer
	(j) kundt's tube
	(k) mass spectrograph
	(l) McLeod gauge
	(m) micrometer
	(n) Nicol's prism
	(o) pyrometer
	(p) Wheatstone bridge

Chemistry :

Match list A with list B.

<u>List A</u>		<u>List B</u>
1. fatty acid	<input type="checkbox"/>	(a) sodium bicarbonate
2. mineral acid	<input type="checkbox"/>	(b) copper nitrate
3. acid salt	<input type="checkbox"/>	(c) acetic acid
		(d) concentrated sulphuric acid
		(e) hydrochloric acid

Botany :

Below are 5 important crops and their families. Match them properly.

<u>List A</u>		<u>List B</u>
1. rubber	<input type="checkbox"/>	(a) palmae
2. coffee	<input type="checkbox"/>	(b) euphorbiaceae
3. tapioca	<input type="checkbox"/>	(c) tilliaceae
4. coconut	<input type="checkbox"/>	(d) ternstroemlaceae
5. tea	<input type="checkbox"/>	(e) malvaceae
		(f) rubiaceae
		(g) liliaceae

Zoology :

<u>List A</u>		<u>List B</u>
1. telophase	<input type="checkbox"/>	(a) chromosomes orientate on equator of cell
2. metaphase	<input type="checkbox"/>	(b) when a cell is not undergoing division
3. anaphase	<input type="checkbox"/>	(c) reformation of chromosomes producing two new nuclei
		(d) separation of chromatids
		(e) chromosomes first become identifiable

Psychology :

<u>List A</u>		<u>List B</u>
1. Galton	<input type="checkbox"/>	(a) individual mental abilities test
2. JND	<input type="checkbox"/>	(b) methodology of psychophysics
3. Binet	<input type="checkbox"/>	(c) first widely administered group test
4. Army alpha	<input type="checkbox"/>	(d) eugenics
		(e) statistics
		(f) hereditary genius

History :

<u>List A</u>		<u>List B</u>
1. Federalist party	<input type="checkbox"/>	(a) adoption of a Homestead Law for the distribution of government lands in the west:
2. Jeffersonian democracy	<input type="checkbox"/>	(b) large scale use of force to impose national policy upon state governments
3. Republican party 1860 - 1900	<input type="checkbox"/>	(c) very sharp identification of the North-South line
4. Roosevelt's New Deal	<input type="checkbox"/>	(d) successful support of major internal improvements on a national scale
		(e) adoption of the most ambitious civil rights legislation ever attempted by the national government

- (f) often regarded as special spokesman for large industrial interests
- (g) attempted to raise agricultural prices by curtailment of production

Geography :

List A

List B

- | | |
|---|----------------------------------|
| 1. Grand Canyon <input type="checkbox"/> | (a) high pressure |
| 2. Gift of Egypt <input type="checkbox"/> | (b) low pressure |
| 3. Cyclone <input type="checkbox"/> | (c) erosion of river Colorado |
| | (d) erosion of river Mississippi |
| | (e) Gift of Nile |
| | (f) Gift of Danube |

Commerce :

List A



List B

- | | |
|---|--|
| 1. a holding company <input type="checkbox"/> | (a) the liability of the company's debenture holders is built in accordance with the articles of association |
| 2. a limited liability company <input type="checkbox"/> | (b) holding bill's of exchange until they are due for payment |
| | (c) institution that employs its capital to obtain controlling interests in other companies |

- (d) holding the assets of a bankrupt company on behalf of creditors
- (e) the liability of the shareholders from the company's debts is limited to the amounts they have agreed to subscribe
- (f) the liability of the company's preference shareholders is dependent on the length of time they have held their shares

Economics :

List A

- 1. marginal fixed costs 
- 2. social costs 

List B

- (a) costs shifted by producers on to society as a whole
- (b) costs incurred in producing goods such as food, clothes etc. whose consumption benefits society
- (c) costs of educating and training labour force in society
- (d) cost equal to average fixed costs
- (e) costs equal to total fixed costs
- (f) zero

5. REARRANGEMENT ITEM :

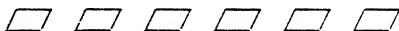
Mathematics :

You are given the following information

$$a=1/6 \quad b=0.60 \quad c=2/9 \quad d=0.56$$

$$e=1/4 \quad f=0.64 \quad \text{Place } a, b, c, d, e, f,$$

in order of size , the greatest first .



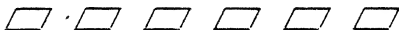
Physics :

Put the following in the order or their size

(a) an atom (b) an electron

(c) a cell (d) a neutron

(e) a neutrino



Chemistry :

Arrange the following in the order of increasing atomic volume

(a) (b) (c) (d) (e)
B, Be, Ba, Ca, C



Botany :

The stages in the history of the housefly are given at random. Arrange them in their correct order.

- (a) egg (b) larva (c) adult (d) pupa

Zoology :

Forms of life are indicated. Arrange them in the order in which they emerged

- (a) mammals (b) birds (c) amphibians
(d) fishes (e) invertebrates
(f) land plants (g) man (h) reptiles

Psychology :

Following are major categories of Bloom's taxonomy. Arrange them in the order of hierarchy as specified by Bloom

- (a) application (b) knowledge (c) analysis
(d) comprehension (e) evaluation
(f) synthesis

History :

Arrange the following events in chronological order

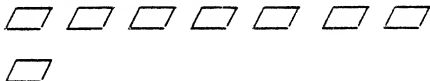
- (a) India becoming republic
- (b) Jallanwalabagh firing
- (c) Montague-Chelmsford reforms
- (d) Round table conference
- (e) India becoming independent



Geography :

Arrange the following in the chronological order of evolution

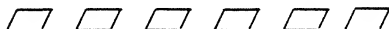
- (a) Peking man
- (b) Neanderthal man
- (c) Australopithecus
- (d) Tarsier
- (e) Ramapithecus
- (f) Swanscombe man
- (g) modern man
- (h) Cro Magnon man



Economics :

Arrange the following forms of government lowest first

- | | |
|------------------|---------------|
| (a) municipality | (b) panchayat |
| (c) corporation | (d) block |
| (e) parliament | (f) assembly |



6. **SIMPLE QUESTION :**

Mathematics :

What is $\log 48.34$ correct to four figures ?

Use log tables.

Physics :

Name the method by which a cup of hot tea could lose heat, if situated on a metal table in a classroom.

Chemistry :

A metal is burned in oxygen and all the products of combustion are weighed. It is found that the weight of the metal seems to have increased by 24 per cent. What is the equivalent weight of the metal ?

Botany :

During which process in photosynthesis is more assimilatory power formed ?

Zoology :

A young female circus acrobat who hangs by her hair as part of her act is wondering whether she could change her profession, if necessary, before it becomes too late. Her problem is this : Her mother is bald but her father has a normal head of hair. Her older brother is rapidly losing his hair and will soon be bald. Let B represent the gene for baldness and b the gene for nonbaldness. In the heterozygous condition B is dominant in males but b is dominant in females. A heterozygous man will be bald but a heterozygous woman will not be bald. Represent the genotype of the elder brother of the young female circus acrobat.

Psychology :

What is intelligence quotient ?

History :

"Oh Liberty what crimes are committed in thy name !" Whose words are these ?

Geography :

Name the region where Eskimos inhabit.

Commerce :

What kind of demand is "houses and window frames" ?

Economics :

What kind of income is "students' grants" that would be excluded from a calculation of the national income ?

7. COMPLETION :

Mathematics :

The measure of variability of a set of test scores is called _____.

Physics :

The phenomenon by which a rod partly immersed in water appears to be bent is known as _____

Chemistry :

The most suitable method for accurate measurement of pH is the _____ method.

Botany :

When a piece of meat is covered with a torn off papaya leaf, the meat _____ in weight.

Zoology :

A lizard placed before three plates, one at a temperature of 50°C , one at a temperature of 37°C and one at a temperature of 15°C consistently moves to the 37°C plate. Many eggs from this lizard were hatched under laboratory conditions. The young lizards consistently moved to the 37°C plate. The behaviour can best be called _____.

Psychology :

The concept of the authoritarian personality as postulated by Adorno, Sanford, Freubel-Brunswik and Levinson in developing the F scale is based upon the personality theory developed specifically by _____.

History :

Many of the Decembrists had seen service in Russia's wars against _____.

Geography :

The country that was able to maintain its independence in the 19th century because of its position as a buffer state between imperial powers was _____

Commerce :

Money at call is lent by the commercial banks to the _____ market.

Economics :

In general, profits are maximised in the short run at the point at which marginal cost equals _____

8. SHORT ANSWER QUESTION :

Mathematics :

If $a=b^c$; $b=c^a$; and $c=a^b$

Show that $abc = 1$

Physics :

There is a suggestion to create an artificial atmosphere round the moon by carrying enough oxygen and hydrogen from the earth and releasing it there. Do you think that the atmosphere will remain permanently ?

Answer the question using the principles of escape velocity and kinetic theory of gases.

Chemistry :

Oxygen and sulphur belong to the same groups in the periodic table and form hydrides H_2O and H_2S . But a marked difference is observed in their boiling points. Explain.

Botany :

Pea plants are usually characterised by root nodules. But when a pea seed is germinated and grown in the laboratory in a culture medium, the root nodules are absent. Why ?

Zoology :

Why should animals depend on the photosynthetic activity of green plants ?

Psychology :

A situation is given below. Determine whether you will use an interview, a psychological test or a projective method. Justify your choice.

A young boy of 10 comes to you for help regarding his sleeplessness and inability to concentrate on studies.

History :

"The nobles fight, the clergy pray and the people pay." Explain the statement with reference to conditions on the eve of the French Revolution.

Geography :

Explain within 100 words the characteristics of Mongoloid.

Commerce :

M/s. XYZ Co. Ltd. (in liquidation) commenced to wind up their affairs as agreed by the members. At a particular stage of their winding up, it was found that the company was unable to pay its debts within the stipulated time. How can the winding up be continued ?

Economics :

Are there any restrictions regarding payment of managerial remunerations under the Companies Act of 1956. Who fixes the managing director's or whole time directors remunerations and how ?

9. LONG ANSWER :

Mathematics :

Find c so that

$$f'(c) = f(b) - f(a) / b - a$$

Where $f(x) = e^x$ and $a=0$, $b=1$

Physics :

Determine the wave length of green line of mercury with a Michelson interferometer ; obtain also the fringe pattern of white light.

Give a neat sketch of the complete experimental arrangement explaining clearly how the interference is brought about. Derive the necessary formula from the wave theory of light.

Chemistry :

An alcohol $C_5H_{11}OH$ gives a ketone on oxidation, which is dehydrated and the resulting alkene oxidised; A mixture of ketone and an acid results. What is the structure of the compound ?

Botany :

Compare the evolutionary status of annonaceae with that of compositae based on vegetative features, floral characters and functional efficiency of reproductive organs.

Zoology :

You are given two test tubes one labelled protein Q and the other protein Z. How could you tell that these tubes contained really different proteins ? Outline the experimental procedure you would follow .

Psychology :

The following are the ratings of an individual : Clinical rating : badly organised personality, dependent, abnormal before illness, narrow interests, little energy, dyspepsia, abnormality in parents, poor muscular tone, unsatisfactory home, hypochondriasis, no group membership. Self assessment : inferiority feelings, touchy, nervous, autonomic symptoms, disgruntled, accident prone, intolerant. Constitution : physique: leptomorph, effort responses : poor, dark vision : poor, static equilibrium: poor. Intellectual functions : low intelligence, low retest reliability.

Test response : high suggestibility, little persistence, slow personal tempo, low fluency, extreme perseveration (high or slow), uneven curve of practice (learning), little improvement during practice, abnormal ranking Rorschach responses high colour/function, ratio, abnormal lack of socialibility, tendency to repression.

- (a) Underline those traits which are due to hereditary influences and tick those which are due to environment
- (b) Encircle those from which it is not possible to disentangle the influences of nature and nurture.
- (c) Is the individual schizophrenic, paranoid, manic depressive, highly neuritic or none of these ?
- (d) Which of the following can best explain the data and how
 - (i) Freud's concept of the failure of the ego
 - (ii) Pavlov's "weakness of nervous functioning"
 - (iii) Watson's "faulty conditioning "
 - (iv) Mc Dougall's failure to achieve integration through the self regarding sentiment.

History :

"The nobles fight; the clergy pray and the people pay." Explain the statement with reference to the conditions on the eve of the French Revolution.

Geography :

Explain is not more than 400 words,

Mongoloid race with special reference to features, region of dominance, life styles.

Commerce :

Define "new inflation".

What are the various methods adopted to control this kind of inflation ?

Economics :

Explain the difference between balance of trade and balance of payment on current account. Which of these two gives a comparatively more complete picture about international transactions ?

10. PROBLEM SOLVING :

Mathematics :

- (a) If $\tan (\Theta + \phi) = \sin (x+y)$ prove that
$$\cot x \sin 2 \phi = \cot \Theta \sin 2 \phi$$
- (b) Separate into its real and imaginary parts the quantity $\tan^{-1}(\alpha + \beta i)$

Physics :

Derive an expression for the speed of transverse wave in a stretched string.

A string 100 cm long and weighing 0.5 gm is stretched till its tension is 4 Kg. Calculate the speed of transverse wave in the string and the frequency of vibration of the string if it vibrates in 3 loops. Given $g=980\text{cm/sec}^2$

Chemistry :

0.16 gm of volatile substance on vaporisation in Victor Meyer's apparatus displaced 43.2 ml of moist air measured at 15°C and 740 mm pressure. Calculate the molecular weight of the substance. (Aqueous tension at 15°C = 12.7 mm)

Botany :

With the help of suitable diagrams bring out the identifying chloroplast characters of 8 members of chlorophyta you have studied. Name each.

Compare the mechanism of electron transfer from solar energy level to chlorophyll - chemical energy level. The species A was divided into 4 sets. Each set was treated with green blue and red lights. The other factors were kept under controlled condition.

What results would you expect in each set with respect to the following tests. ?

- (a) the leaves are subject to IKI test
- (b) evolution of oxygen bubbles per 5/mts duration is tested
- (c) transformation in the appearance of chloroplasts is observed.

Zoology :

Give an account of the body wall of hydra and mention the part played by the interstitial cells in the life of hydra. Two jars containing equal amounts of elodea plant and water are prepared. Fifty hydras are added to each jar

one jar is placed in a dark closet and the other in a brightly lighted area. The temperature of the two jars is kept the same. On which jar would you expect to find gonads on the hydras after several days ? Explain your answer.

Economics :

Give a brief explanation of the concept of 'elasticity of demand'.

In the following table are given prices of certain commodities together with total outlay in the case of each of in a town.

<u>Commodity</u>	<u>Price</u> Rs.	<u>Total outlay per annum</u> (in thousands of rupees)
Rice	28/- md	340
Bajri	16/- md	192
Fruit & vegetables	3/- Doz.	120
Petrol	3/75 gallon	54

- Assuming that there are 2000 families with 6 members in a family on an average, interpret the above data.
- If the prices of above commodities rise by 2 per cent or fall by 5 per cent all over, what will be the effect on total outlay ?
- If the price of petrol, fruit and rice go up by 5 per cent or
 - if the price of petrol and rice go up by 10 per cent what will happen to demand for all the commodities ?

Psychology :

Here are two poems which are learned by two groups of subjects :

- A. Families when a child is born
Want it to be intelligent

I through intelligence
Having wrecked my whole life
Only hope the baby will prove
Ignorant and stupid
Then he may crown a tranquil life
By becoming a Cabinet Minister

- B. Vox Sox Lox Hox
Tuis Tous Suis Suus
Hor Tor Sut Syt
Zirk Tork Nost Pist
Sip Hip Dip Nip
Qua Lyz Perz Dit

Group I 15 year old students read A and B ten times each. Group II 15 year old students read A and B until the first correct repetition. After 2 weeks the reproductions were as follows :

	<u>Poem A</u>	<u>Poem B</u>
Group I	80%	60%
Group II	90%	70%
After 6 weeks		
Group I	50%	20%
Group II	60%	60
After 6 months		
Group I	20%	5%
Group II	30%	5%

1. Draw relevant conclusions with regard to remembering and forgetting.
2. What factors influence good retention ?
3. Represent the data graphically.
4. It is predicted that production after a year will be as follows

	<u>Poem A</u>	<u>Poem B</u>
Group I	2%	0%
Group II	5%	0%

Comment on this.

History :

"The idea of liberty as formulated in the 18th century, although valid enough for that time has in one fundamental respect ceased to be applicable to the situation in which we find ourselves. In the 18th century the most obvious oppressions from which men suffered derived from governmental restraints on the free activity of the individual. Liberty was therefore naturally conceived in terms of emancipation of the individual from such restraints. In the economic realm, this meant the elimination of governmental restraints on the individual, governmental restraints on the individual in choosing his occupation, in contracting for the acquisition and disposal of property and the purchase and sale of personal services. But in our time , as a result of the growing complexities

of a technological society,
(a) the emancipation of the individual from governmental restraint in his economic activities has created new oppression so that (b) for the majority of men liberty can be achieved only by an extension of governmental regulation of competitive business enterprise."

Defend or attack the truth of proposition (a) above. In doing this take into consideration specific conditions in the areas of economic and political life in America from the civil war to the present. Read the essay assignment carefully. You are to write both Part A and Part B of the assignment. Organise your ideas before you start to write. In your analysis, show clearly the interrelationship of the pertinent ideas and arguments. If you introduce historical facts, integrate them into your argument or exposition.

Commerce :

The following extract of costing information relates to commodity A for the year ending 31.12.1974.

	Rs.
Purchases of raw materials	60,000
Works on cost	20,000
Direct wages	50,000
Carriage inwards	1,000

Stock - Jan. 1, 1974

Raw materials	10,000
Work in progress	2,400
Finished goods (2,000) tons	8,000

Stock - Dec. 31, 1974

Raw Materials	11, 000
Work in progress	3, 000
Finished goods (4, 000) tons	?
Office on cost	4, 000
Sales	1, 50, 000

Selling expenses were 40 paise per ton.
32, 000 tons of commodity were produced
during the period.

Ascertain

- (a) cost of output and
- (b) net profit for the period.

XXXXX

XXX

X